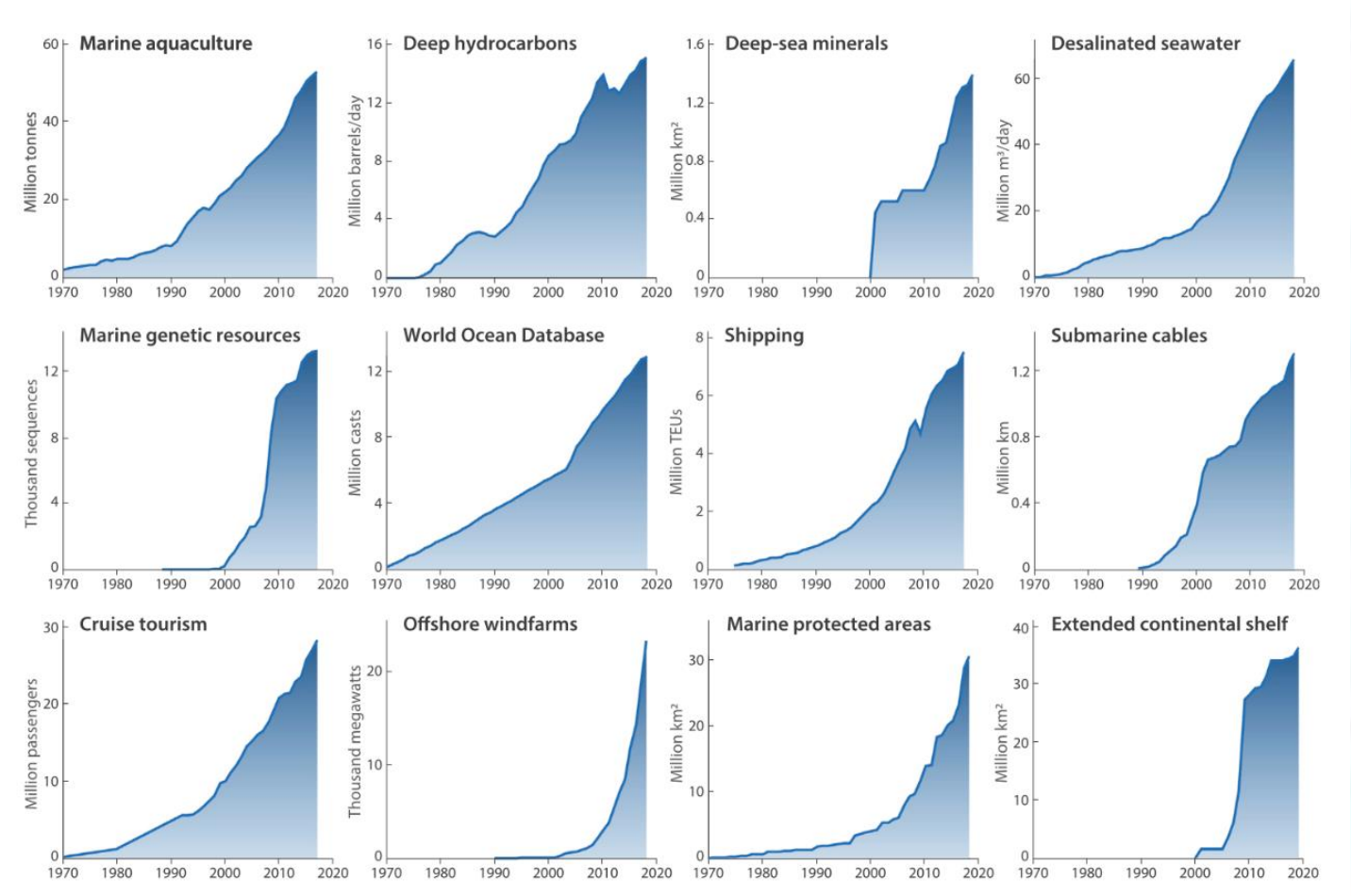
# the weekly anthropocene

*dispatches from the wild, weird world of humanity and its biosphere*

By Sam Matey, February 5 2020




The State of the World's Oceans. In the Anthropocene, Earth's oceans are undergoing profound change from a variety of human activities. The ocean has absorbed approximately 93% of the additional heat trapped by human-emitted greenhouse gases, and sea surface temperatures globally have risen by an average of 0.7°C since 1900. This has already led to major second-order changes in ocean systems, from perturbing nutrient cycles to increased stratification between ocean layers to decreased oxygen availability in many areas. As another consequence of burning fossil fuels, ocean acidity has increased by 26 percent since the Industrial Revolution (due to CO2 reacting with seawater to form carbonic acid), putting animals from scallops to corals at risk of having their calcium-based shells slowly dissolve. One of the world's most biodiverse ecosystems gets the worst of both of these trends: between bleaching due to heatwaves and acidification eating away at their skeletons, coral reefs are in serious jeopardy. Intergovernmental Panel on Climate Change (IPCC) simulations found that "coral reefs are projected to decline by a further 70–90% at 1.5°C [of global warming above pre-industrial baseline] with larger losses (>99%) at 2°C."

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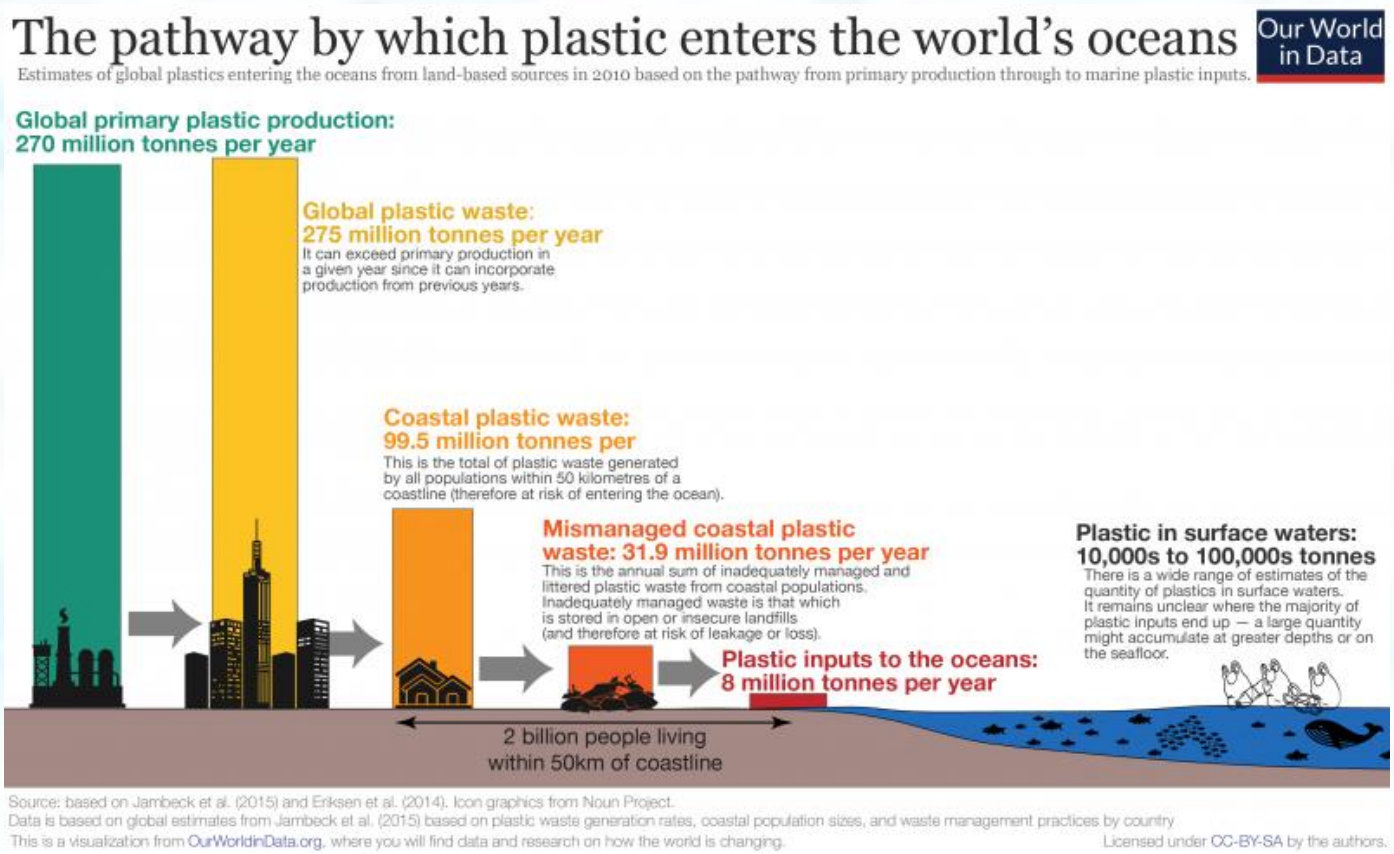
Sea level rise (due to both melting ice caps and thermal expansion as ocean waters warm) and more intense cyclonic storms (due to warmer waters providing more energy) pose a direct threat to coastal settlements. The 2019 Intergovernmental Panel on Climate Change (IPCC) special report on the oceans and cryosphere stated that without substantial adaptation efforts, "future flood losses in the 136 largest coastal cities are projected to rise from 6 billion USD [per year] at present to 1 trillion USD [per year} in 2050. The report also highlighted the particular plight of indigenous communities in the Arctic (a region warming considerably faster than the rest of the world), at risk from melting permafrost leading to coastal erosion, shifting food webs imperiling traditional self-sufficiency, and a history of being forced into marginal land leaving them especially vulnerable to sea level rise. The same report warns of profound ecological effects on all ocean ecosystems due to climate change. Under all emissions scenarios, the 21st century is expected to see decreased marine biomass, lower fisheries catch potential, and a shift in species composition, with the tropics feeling the sharpest declines. The report notes that science-based management could mitigate much of this, but also warns of challenges to fisheries governance as shifting fish populations cross maritime borders. (For the full report, check out www.ipcc.ch/srocc/.)




The carbon dioxide-driven double threats of climate change and ocean acidification are not the only new pressures on the world ocean. A 2015 study found that approximately 8 million tons of plastic entered the ocean in

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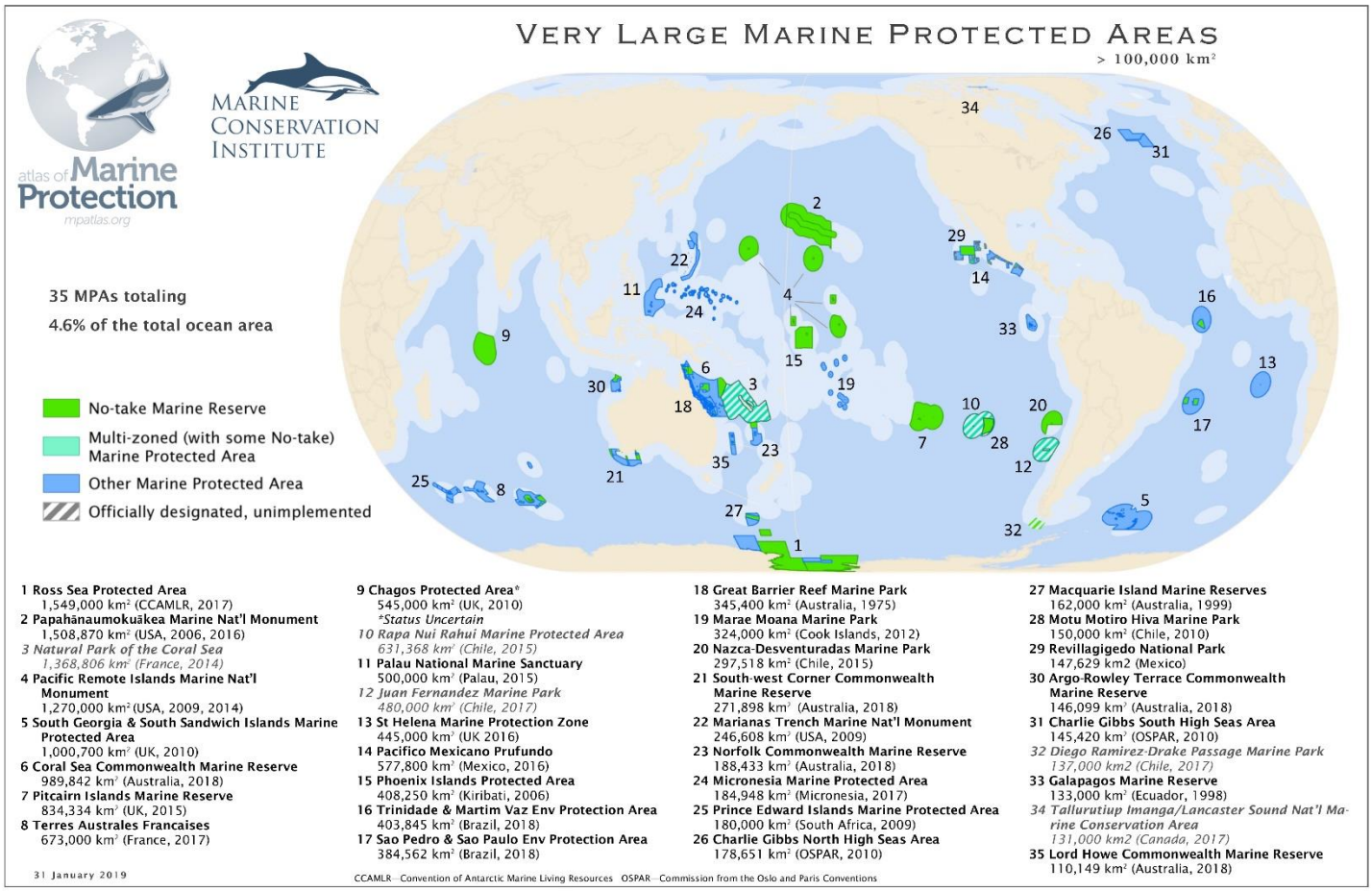
2010, and that the amount is set to rise substantially by 2025. Plastic waste has already permeated the marine ecosystem, having been found in the Arctic, the Mariana Trench, seabirds' stomachs, and seafood eaten by humans. Furthermore, around the world, human civilization is using ocean resources to an unprecedented degree: shipping, offshore oil and gas drilling, deep-sea mining, cruise ship tourism, and marine aquaculture have all increased substantially-in some cases exponentially-since the year 2000. Even relatively harmless ways humans interact with the oceans, from offshore wind farms to analyzing marine genetic resources to laying submarine telecommunications cables, have intensified drastically over the same period. A recent paper dubbed this phenomenon the "Blue Acceleration." (See graph at the beginning of this newsletter, and tinyurl.com/BlueAcceleration.).




However, the last few years have also seen growing momentum for ocean conservation around the world. The 2010s saw an unprecedented boom in the creation of large-scale marine protected areas (MPAs), including the massive international Ross Sea Protected Area in Antarctica, Australia's Coral Sea and South-West Corner MPAs, the Obama Administration's expansion of Papahanaumokuakea and PRIMNM MPAs, Palau's National Marine Reserve, the Cook

Islands' Marae Moana MPA, the UK's Pitcairn, St. Helena, and South Georgia MPAs, Mexico's Revillagigedo MPA, and Chile's Rapa Nui, Juan Fernandez, and Nazca-Desadventuras MPAs (see map above). All of the above protected over 100,000 square kilometres of ocean, and many went much further-the largest, the Ross Sea MPA, puts 1.1 million square kilometres off limits to commercial fishing. By removing pressures from extractive industries these MPAs help the local ecosystems retain resilience to climate change and other threats. (For more, see http://www.mpatlas.org/protection-dashboard/very-large-mpas/).

Furthermore, all five Arctic littoral nations (plus major fishing powers China, Japan, Iceland, South Korea, and the European Union) signed an unprecedented agreement in 2018 that put the high seas of the Central Arctic Ocean off-limits to fishing for at least 16 years, until a scientific management regime can be formulated. This is a rare example of precautionary protective action to address an ecological problem from before it starts. As sea ice melts, the Central Arctic's marine life is potentially at risk from fishing fleets, but world powers have agreed to press the pause button on extractive industry in this newly vulnerable ecosystem before it has the chance to do serious damage. (Pictured: Central Arctic Ocean. For more, see tinyurl.com/Central-Arctic-Ocean).


Source: Flanders Marine Institute, Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 9, accessed Feb. 17, 2017, http://dx.doi.org/10.14284/242



In addition, new data has shown that scientific fisheries management (like catch limits to prevent overfishing) is working wherever it's being used. A landmark study published in 2019 analyzed the fish stocks of the world's fisheries that are scientifically monitored (comprising about 50% of world fish catch and mostly located in the waters of Europe, the Americas, South Africa, Australia, and New Zealand). They found that on average, these fisheries have seen increases in fish stocks over the past few decades-and the more intense the fisheries management, the better fish populations are doing. This is excellent news, speaking

well of humanity's capacity to manage ecosystems sustainably-although it should not be taken to mean that world fish stocks are safe. Many regions of the world, such as the Mediterranean and North Africa, South Asia, West Africa, and East Asia, are not scientifically managed and still plagued by overfishing, much of which is illegal, unregulated, or unreported. Furthermore, climate change will likely cause all-new problems for world fisheries. (See tinyurl.com/FisheriesManagementWorking).

On the plastics front, 2019 and 2020 have seen an impressive wave of worldwide action to limit single-use plastics. In 2019, the European Union voted to ban most single-use plastics, and The Ocean Cleanup has launched the world's first successful projects to clean up plastic in marine and riverine environments. In January 2020 alone, China announced that single-use plastic bags would be banned in all major cities and single-use straws would be banned in the restaurant industry by the end of the year. On January 21st, Starbucks pledged to become "resource positive", which among other goals (such as reducing direct and supply-chain carbon emissions 50% by 2030) involves transitioning from single-use plastic to reusable packaging. And Super Bowl 54 (held on February 2nd) phased out 99.4% of its single-use plastic, replacing single-use plastic cups at the stadium with aluminum (pictured) and plastic silverware with compostable alternatives. While the effect on plastic levels in the water is likely unquantifiable at this time, these efforts may indicate the beginnings of a civilizational shift away from disposable plastics. (See tinyurl.com/ChinaPlasticsBan, tinyurl.com/StarbucksResourcePositive, and tinyurl.com/SuperBowl54Waste).


In conclusion, as climate change accelerates and conservation efforts strive on, the full story of Earth's oceans in the age of humanity has yet to be written. The UN has declared 2021-2030 the "Decade of Ocean Science for Sustainable Development," with a focus on developing "the science we need for the ocean we want." (See www.oceandecade.org). Choosing what kind of ocean we want, and taking the actions to make it happen, is the responsibility of all scientists, entrepreneurs, policymakers, and citizens in the Anthropocene.